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EXAMINER	
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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/904,432	RAGHAVAN, SREEN	
	Examiner	Art Unit	
	Lawrence B. Williams	2611	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *15 February 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-11,13-17,19-35 and 37-52* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-11,13-17,19-35 and 37-52* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

1. Applicant's arguments with respect to claims 1-11, 13-17, 19-35, 37-52 have been considered but are moot in view of the new ground(s) of rejection.

Drawings

2. The drawings were received on 15 February 2006. These drawings are not acceptable. Applicant's Fig. 2 still contains multiple references to 201-P, and 210-P. The examiner suggests applicant delete one of the blocks such that the blocks would read 201-1....201-P.

Claim Objections

3. Claim 40 is objected to because of the following informalities: The examiner suggest applicant replace the word "filter" in line 1 with "filtering"

Appropriate correction is required.

4. Claim 52 is objected to because of the following informalities: The examiner suggest applicant rewrite claim 52 after the preamble to better define applicant's invention.

Appropriate correction is required.

Claim Rejections - 35 USC § 112

5. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

6. Claims 1-11, 13-17, 19-26 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter, which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Claim 1 cites the newly amended limitation " wherein the receiver includes a down-conversion circuit corresponding to each of the K frequency separated channels that down converts to a base-band signal in a single step" in lines 7-8. The specification does not include any description of a single-step down conversion circuit.

7. Claims 27-35, 37-43 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter, which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Claim 27 cites the newly amended limitation " up-converting each of the K symbols **in a single up-conversion step** to form an upconverted signal at one of a set of carrier frequencies" line 8. The specification does not include any description of a single up conversion step.

8. Claims 44-45 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter, which was not

described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Claim 44 cites the newly amended limitation " wherein the means for transmitting includes an up-converter that up-converts in a single step" in lines 5-6. The specification does not include any description of means for transmitting that includes an up-converter that up-converts in a single step.

9. Claims 46-52 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter, which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Claim 46 cites the newly amended limitation " wherein the receiver portion includes a down-conversion circuit that down-converts in a single step" in lines 7-8. The specification does not include any description of a receiver portion that includes a down-conversion circuit that down-converts in a single step.

Claim Rejections - 35 USC § 103

10. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

11. Claim 1 is rejected under 35 U.S.C. 103(a) as being unpatentable over Shively et al. (US Patent 6,418,161 B1) in view of Merriam, Jr. (US Patent 6,975,685 B1).

(1) With regard to claim 1, Shively et al. discloses in Fig(s) 3, 4, a communication system, comprising: a transmitter, the transmitter coupled to receive N parallel bits of data and transmit the N parallel bits of data into K frequency separated channels on a conducting transmission medium (Fig. 3, element 15, twisted pair) where N and K are integers (col. 10, lines 30-45), and a receiver coupled to receive data from the K frequency separated channels from the transmission medium and recover the N parallel bits of data (elements 16-19, Fig. 3). Shively is silent as to a down-conversion circuit.

However, Merriam, Jr. discloses in Fig. 6, an apparatus and method for multi-channel communications systems wherein he discloses a receiver including a down-conversion circuit (elements 602-606) corresponding to separated channels that down converts to a base-band signal in a single step (col.6, lines 44-65).

It would have been obvious to one skilled in the art at the time of invention to incorporate the teachings of Merriam, Jr. as a method of efficiently method of receiving signals that maximizes the use of hardware resources (col. 2, lines 3-6).

12. Claims 2-3, 6, 15, 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shively et al. (US Patent 6,418,161 B1) in view of Merriam, Jr. (US Patent 6,975,685 B1) as applied to claim 1 above, and further in view of Esteban et al. (US Patent 4,55,649).

(1) With regard to claim 2, as noted above, Shively in combination with Merriam et al.

disclose all limitations of claim 1 above. Shively also discloses K modulators (Fig. 4, element 42, the multi-carrier modulator contains a plurality of modulators, one for each QAM channel) wherein each of the K modulators encodes one of the K subsets of the N parallel bits of data and creates an output signal modulated at a carrier frequency associated with one of the K frequency separated channels (col. 10, lines 30-45); and an adder (element 44, col. 10, lines 48-52) that receives the output signal from each of the K modulators and generates a transmit sum signal for transmission on the conducting transmission medium (element 15).

They do not however disclose a bit allocation circuit that receives the N parallel bits of data and creates K subsets of data bits, though Shively does disclose a serial to parallel buffer for allocation of bits (col. 10, lines 62-67).

However, Esteban et al. discloses in Fig. 1A, a method and apparatus for efficient statistical multiplexing of voice and data signals wherein he discloses a bit allocation circuit (element 14) that receives parallel bits of data and creates subsets of data bits (col. 5, lines 44-51).

It would have been obvious to one skilled in the art at the time of invention to incorporate the teachings of Esteban et al. as a method of increasing efficiency in the system.

(2) With regard to claim 3, Shively et al. also discloses in Fig(s). 3, 4, wherein at least one of the K modulators includes a data encoder (Fig. 3, element 13) that receives the one of the K subsets of the N parallel bits of data associated with the at least one of the K modulators and outputs an encoded signal; a symbol mapper (Shively et al. teaches a QAM tones for each channel with a respective constellation, col. 10, lines 39-41) coupled to receive the encoded signal and output a symbol; and an up-converter coupled to receive symbols from the symbol

mapper and generate the output signal, wherein the up-converter outputs data at the carrier frequency of one of the K frequency separate channels that corresponds with the at least one of the K modulators (col. 10, lines 43-47). Shively et al. teaches the modulator modulating N subcarriers by corresponding symbols to generate N QAM tones, which would inherently imply and up-converter.

(3) With regard to claim 6, Shively et al. discloses the symbol mapper as a QAM mapper which maps the encoded output signal into a symbol (col. col. 10, lines 37-40). Though Shively is silent as to both an in-phase and quadrature signal, it is well known in the art that a QAM signal can be expressed as a linear combination of two orthonormal function, sin/cosine; in-phase/quadrature. Therefore claim 6 does not constitute a patentable limitation.

(4) With regard to claim 15, claim 15 inherits all limitations of claim 2 above. As noted above, the combination of Shively et al., Merriam, Jr. and Esteban et al. disclose all limitations of claim 2, above. Furthermore, Shively et al. also discloses in Fig. 4, wherein the receiver comprises: K demodulators (44), each of the K demodulators (Shively discloses plural modulators in the transmitter, which would inherently include plural demodulators in the receiver) coupled to receive a signal from the conducting transmission medium (Fig. 3, element 15, twisted pair) the signal being the transmit sum signal transmitted through the conducting transmission medium, and retrieving one of the K subsets of data bits; and bit parsing circuit (49) that receives each of the K subsets of data bits from the K demodulators and reconstructs the N data bits transmitted by the transmitter (col. 10, lines 48-61).

(5) With regard to claim 16, claim 16 inherits all limitations of claim 15, above. Furthermore, Shively et al. also discloses wherein the receiver further includes an input buffer

(Fig. 4, elements, 46-47) coupled between the K demodulators and the conducting transmission medium (element 15, twisted pair). Elements 46 and 47 would act as an input buffer since both the A/D conversion and cyclic prefix removal and S/P would require the signal to buffered while the conversions and removal takes place.

13. Claim 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over Shively et al. (US Patent 6,418,161 B1) in combination with Merriam, Jr. (US Patent 6,975,685 B1) and Esteban et al. (US Patent 4,55,649) as applied to claim 16 above, and further in view of Applicant's Admitted Prior Art.

Claim 17 inherits all limitations of claim 16 above. As noted above, the combination of Shively et al., Merriam, Jr., and Esteban et al. disclose all limitations of claim 16. They do not however disclose wherein the input buffer receives a differential receive sum signal. However Applicant's Admitted Prior Art teaches in Fig. 1, receiving differential signal in a conventional SERDES device.

It would have been obvious to one skilled in the art at the time of invention to incorporate the teachings of Applicant's Admitted Prior Art as a known method of implementing a SERDES device.

14. Claims 4-5, 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shively et al. (US Patent 6,418,161 B1) in combination with Merriam, Jr. (US Patent 6,975,685 B1) and Esteban et al. (US Patent 4,55,649) as applied to claim 3 above, and further in view of Rowan et al. (US Patent 6,407,843 B1).

(1) With regard to claim 4, claim 4 inherits all limitations of claim 3 above. As noted above the combination of Shively et al., Merriam, Jr. and Esteban et al. disclose all limitations of claim 3. They do not however teach a digital-to-analog converter coupled between the symbol mapper and the up-converter. However, Rowan et al. discloses a digital-to-analog converter coupled between a symbol mapper and an up-converter (col. 6, lines 45-50).

It would have been obvious to one skilled in the art at the time of invention to incorporate the teachings of Rowan et al. with the combined teachings of Lindholm and Applicant's Admitted Prior Art as a method of achieving high data rates with high bandwidth efficiencies.

(2) With regard to claim 5, Rowan et al. also discloses in Fig. 4, the use of a trellis encoder (406).

It would have been obvious to one skilled in the art at the time of invention to incorporate the teachings of Rowan et al. as a method of achieving high data rates with high bandwidth efficiencies.

(3) With regard to claim 7, Lindholm discloses pulse shape filtering n Fig. 6. Though he is silent as to the type of filtering, it would be obvious to one skilled in the art that the type of filtering would be a mere design choice.

15. Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Shively et al. (US Patent 6,418,161 B1) in combination with Merriam, Jr. (US Patent 6,975,685 B1), Esteban et al. (US Patent 4,55,649) and Rowan et al. (US Patent 6,407,843 B1) as applied to claim 4 above, and further in view of Miller et al. (US Patent 5,930,231).

Claim 8 inherits all limitations of claim 4, above. As noted above, the combination of Shively et al., Merriam, Jr., Esteban et al. and Rowan et al. disclose all limitations of claim 4 above. They do not however teach the system further including a low pass filter analog filter coupled between the digital-to-analog converter and the up-converter.

However, Miller et al. teaches in Fig. 10, low pass filter analog filter coupled between the analog-to-digital converter and a quadrature down-converter. It would be inherent that the opposite configuration would make up the up-conversion portion in the transmitter.

It would have been obvious to one skilled in the art at the time of invention to incorporate the teachings of Miller et al. as a method of processing predetermined spectral subbands within a predetermined spectral band.

16. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Shively et al. (US Patent 6,418,161 B1) in combination with Merriam, Jr. (US Patent 6,975,685 B1) and Esteban et al. (US Patent 4,55,649) as applied to claim 6 above, and further in view of Lindholm (US Patent 6,477,207 B1).

Claim 9 inherits all limitations of claim 6 above. As noted above, the combination of Shively et al., Merriam, Jr., Esteban et al. disclose all limitations of claim 6, above. They do not disclose wherein the up-converter generates a first signal by multiplying the in-phase portion of the complex symbol by a sine function of the carrier frequency, generates a second signal by multiplying the out-of-phase portion of the complex symbol by a cosine function of the carrier frequency, and summing the first signal with the second signal to generate the output signal.

However, Lindholm discloses in Fig. 6, wherein the up-converter generates a first signal by multiplying (62a) the in-phase portion of the complex symbol by a sine function of the carrier frequency, generates a second signal by multiplying (62b) the out-of-phase portion of the complex symbol by a cosine function of the carrier frequency, and summing (63) the first signal with the second signal to generate the output signal (50).

It would have been obvious to one skilled in the art at the time of invention to incorporate the teachings of Lindholm as a method of implementing simple and efficient modulation and demodulation scheme where bit streams are transmitted on carriers on different bands or channels.

17. Claims 10, 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shively et al. (US Patent 6,418,161 B1) in view of Merriam, Jr. (US Patent 6,975,685 B1) as applied to claim 1 above, and further in view of Applicant's Admitted Prior Art.

(1) With regard to claim 10, claim 10 inherits all limitations of claim 1 above. As noted above, Shively et al. in combination with Merriam, Jr. disclose all limitations of claim 1 above. However, Applicant's Admitted Prior Art discloses wherein the transmission medium is a copper backplane (pg. 2, lines 22-23) and the transmitter includes a differential output driver (pg. 2, lines 7-9).

It would have been obvious to one skilled in the art at the time of invention to incorporate the teachings of Applicant's Admitted Prior Art as a method of implementing a conventional SERDES device.

(2) With regard to claim 11, Applicant's Admitted Prior Art also discloses wherein the transmission medium is FR4 copper trace (pg. 2, lines 22-23) and the transmitter includes a differential output driver (pg. 2, lines 7- 9).

It would have been obvious to one skilled in the art at the time of invention to incorporate the teachings of Applicant's Admitted Prior Art as a method of implementing a conventional SERDES device.

18. Claims 13-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shively et al. (US Patent 6,418,161 B1) in combination with Merriam, Jr. (US Patent 6,975,685 B1) and Esteban et al. (US Patent 4,55,649) as applied to claim 2 above, and further in view of Lindholm (US Patent 6,477,207 B1).

(1) With regard to claim 13, claim 13 inherits all limitations of claim 2 above. As noted above the combination of Shively et al., Merriam, Jr. and Esteban et al. disclose all limitations of claim 2. They do not however disclose wherein a subset of bits at a lower carrier frequency contains fewer bits than a subset of bits associated with a higher carrier frequency.

However, Lindholm teaches wherein a subset of bits at a lower carrier frequency contains fewer bits than a subset of bits associated with a higher carrier frequency (col. 5, lines 48-50).

It would have been obvious to one skilled in the art at the time of invention to incorporate the teachings of Lindholm as a method of implementing simple and efficient modulation and demodulation scheme where bit streams are transmitted on carriers on different bands or channels.

(2) With regard to claim 14, Lindholm also discloses wherein each of the K subset of bits include the same number of data bits (col. 5, lines 48-50).

It would have been obvious to one skilled in the art at the time of invention to incorporate the teachings of Lindholm as a method of implementing simple and efficient modulation and demodulation scheme where bit streams are transmitted on carriers on different bands or channels.

19. Claims 19, 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shively et al. (US Patent 6,418,161 B1) in combination with Merriam, Jr. (US Patent 6,975,685 B1) and Esteban et al. (US Patent 4,55,649) as applied to claim 15 above, and further in view of Lindholm (US Patent 6,477,207 B1).

(1) With regard to claim 19, claim 19 inherits all limitations of claim 15, above. As noted above, the combination of Shively et al., Merriam, Jr., and Esteban et al. disclose all limitations of claim 15 above. They do not however disclose an equalizer circuit coupled to receive the symbol from the down-conversion circuit and create an equalized symbol; and a decoder which receives the equalized symbol and retrieves the one of the K subsets of bits associated with the at least one of the K demodulators.

However, Lindholm teaches in Fig. 9c, an equalizer circuit (93) coupled to receive the symbol from the down-conversion circuit and create an equalized symbol; and a decoder (47) which receives the equalized symbol and retrieves the one of the K subsets of bits associated with the at least one of the K demodulators (col. 9, lines 23-40).

It would have been obvious to one skilled in the art at the time of invention to incorporate the teachings of Lindholm as a method of implementing simple and efficient modulation and demodulation scheme where bit streams are transmitted on carriers on different bands or channels.

(2) With regard to claim 23, claim 23 inherits all limitations of claim 19 above. Furthermore, Lindholm also discloses in Fig. 6, wherein the symbol includes an in-phase signal and a quadrature signal and the down-converter multiplies the received sum signal by a cosine function to retrieve the in-phase signal component and by a sine function to receive the quadrature component.

It would have been obvious to one skilled in the art at the time of invention to incorporate the teachings of Lindholm as a method of implementing a simple and efficient modulation and demodulation scheme where bit streams are transmitted on carriers on different bands or channels.

20. Claims 20, 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shively et al. (US Patent 6,418,161 B1) in combination with Merriam, Jr. (US Patent 6,975,685 B1), Esteban et al. (US Patent 4,55,649) and Lindholm (US Patent 6,477,207 B1) as applied to claim 19 above, and further in view of Rowan et al. (US Patent 6,407,843).

(1) With regard to claim 20, claim 20 inherits all limitations of claim 19 above. As noted above, the combination of Shively et al., Merriam, Jr., Esteban et al., and Lindholm discloses all limitations of claim 19 above. They do not however teach an analog-to-digital converter coupled between the down-converter and the equalizer.

However, Rowan et al. discloses in Fig. 9B, an analog-to-digital converter coupled between the down-converter and the equalizer (pg. 7, lines 4-21).

It would have been obvious to one skilled in the art at the time of invention to incorporate the teachings of Rowan et al. as a method of achieving high data rates with high bandwidth efficiencies.

(2) With regard to claim 21, Lindholm discloses in Fig. 9c, the use of low pass filtering (92a, 92b) to remove interfering spectral components (anti-aliasing) (col. 9, lines 30-32).

It would have been obvious to one skilled in the art at the time of invention to include the teachings of Lindholm between the A/D and the equalizer to remove interfering spectral components.

21. Claims 27, 30-31, 44 are rejected under 35 U.S.C. 102(e) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Shively et al. (US Patent 6,418,161 B1).

(1) With regard to claim 27, Shively et al. discloses in Fig(s). 3, 4, a method of communicating between components over a conducting transmission medium, comprising; separating N bits into K subsets of bits; encoding each of the K subsets of bits to form encoded subsets of bits; mapping each of the K encoded subsets of bits onto a symbol set to generate a K symbols representing each of the K subsets of bits; up-converting (the symbols are modulated by respective subcarriers to generate respective QAM tone, corresponding to applicant's single up-conversion step) each of the K symbols in a single up-conversion step to form an up-converted signal at one of a set of K carrier frequencies (col. 10, lines 31-47); summing the up-converted

signals representing each of the K subsets of bits to generate a transmit sum signal; and coupling the transmit sum signal to the conducting transmission medium (col. 10, lines 48-52).

(2) With regard to claim 30, Shively et al. also discloses wherein mapping each of the encoded subsets of bits include QAM mapping (col. 10, lines 37-41).

(3) With regard to claim 31, Shively also discloses the method of claim 27 further including converting the K symbols to analog signals (Fig. 4, element 44).

(4) With regard to claim 44, Shively et al. also discloses a system for communication between components, comprising: means for allocating N bits of input data into K subsets (Fig. 4, element 41); means for encoding each of the K subsets (Fig. 3, element 13); and means for transmitting (Fig. 4, elements 41-44) each of the K subsets into one of K channels on a conducting transmission medium, wherein the means for transmitting includes an up-converter that up-converts in a single step (the symbols are modulated by respective subcarriers to generate respective QAM tone, corresponding to applicant's single up-conversion step) each of the K symbols in a single up-conversion step to form an up-converted signal at one of a set of K carrier frequencies (col. 10, lines 31-47).

22. Claim 28 is rejected under 35 U.S.C. 103(a) as being unpatentable over Shively et al. (US Patent 6,418,161 B1) as applied to claim 27 above, and further in view of Lindholm (US Patent 6,477,207 B1).

Claim 28 inherits all limitations of claim 27 above. As noted above, Shively et al. discloses all limitations of claim 27 above. Shively et al. does not however teach wherein

symbols at lower carrier frequencies represent fewer bits than symbols transmitted at higher carrier frequencies.

However, Lindholm discloses wherein symbols at lower carrier frequencies represent fewer bits than symbols transmitted at higher carrier frequencies.

It would have been obvious to one skilled in the art at the time of invention to incorporate the teachings of Lindholm as a method of implementing simple and efficient modulation and demodulation scheme where bit streams are transmitted on carriers on different bands or channels.

23. Claim 29 is rejected under 35 U.S.C. 103(a) as being unpatentable over Shively et al. (US Patent 6,418,161 B1) as applied to claim 27 above, and further in view of Rowan et al. (US Patent 6,407,843 B1).

Claim 29 inherits all limitations of claim 27 above. As noted above, Shively et al. discloses all limitations of claim 17. Shively et al. does not however teach wherein encoding each of the K of bits includes encoding at least one of the K subsets of bits with a trellis encoder, though one would be motivated to do so to for proven superior performance in a noisy environment.

However, Rowan et al. discloses in Fig. 4, wherein encoding each of the K subsets of bits includes encoding at least one of the K subsets of bits with a trellis encoder.

It would have been obvious to one skilled in the art at the time of invention to incorporate the teachings of Rowan et al. for proven superior performance in a noisy environment.

24. Claims 32, 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shively et al. (US Patent 6,418,161 B1) as applied to claim 31 above, and further in view of Rowan et al. (US Patent 6,407,843 B1).

(1) With regards to claims 32, 33, claims 32 and 33 inherit all limitations of claim 31 above. As noted above, Shively et al. discloses all limitations of claim 31 above. Shively et al. does not teach filtering prior to converting the K symbols to analog signals.

However, Rowan et al. also discloses in Fig. 9B, providing filtering (914A) prior to converting the K symbols to analog signals. Rowan et al is silent as to the type of filtering. It would be obvious to one skilled in the art that the type of filtering used would be a mere design choice.

It would have been obvious to one skilled in the art at the time of invention to incorporate at least some type of filtering before converting the symbols to analog signals to improve accuracy.

25. Claims 34, 39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shively et al. (US Patent 6,418,161 B1) as applied to claim 27 above, and further in view of Lindholm (US Patent 6,477,207 B1).

As noted above, Shively et al. discloses all limitations of claim 27. Furthermore Shively et al. also discloses in Fig. 4, receiving a receive sum signal from the conducting transmission medium, the receive sum signal being the transmit sum signal after transmission through the conducting transmission medium; down-converting (element 47) the received sum signal in a single down-conversion step into a set of K signals; and decoding (Fig. 3, element 18) symbols

to reconstruct the K subsets of bits; and parsing K subsets of bits into N bits (col. 10, lines 55-61).

Shively et al. is silent as to equalizing of the K received signals. However, Lindholm teaches in Fig. 9c, an equalizer circuit (93) coupled to receive symbols from the down-conversion circuit and create an equalized symbol; and a decoder (47) which receives the equalized symbol and retrieves the one of the K subsets of bits associated with the at least one of the K demodulators (col. 9, lines 23-40).

It would have been obvious to one skilled in the art at the time of invention to incorporate the teachings of Lindholm as a method of implementing simple and efficient modulation and demodulation scheme where bit streams are transmitted on carriers on different bands or channels.

(2) With regard to claim 39, Shively et al. also discloses in Fig. 4, the method including analog-to-digital conversion.

26. Claims 35, 37 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shively et al. (US Patent 6,418,161 B1) in view of Lindholm (US Patent 6,477,207 B1) as applied to claim 34 above, and further in view of Applicant's Admitted Prior Art.

(1) With regard to claim 35, claim 35 inherits all limitations of claim 34 above. As noted above, Shively et al. in combination with Lindholm disclose all limitations of claim 34. They do not however disclose wherein receiving the receive sum signal includes receiving a differential signal from a copper transport medium.

However Applicant's Admitted Prior Art teaches wherein receiving the receive sum signal includes receiving a differential signal from a copper transport medium (pg. 2, line 8).

It would have been obvious to one skilled in the art to combine the teachings of Applicant's Admitted Prior Art with the teachings of Lindholm as a method of implementing a conventional SERDES device.

(2) With regard to claim 37, Lindholm also discloses wherein down-converting the received sum signal includes receiving a symbol transmitted at a corresponding carrier frequency (col. 9, lines 23-31).

27. Claim 38 is rejected under 35 U.S.C. 103(a) as being unpatentable over Shively et al. (US Patent 6,418,161 B1) in view of Lindholm (US Patent 6,477,207 B1) as applied to claim 34 above, and further in view of Miller et al. (US Patent 5,930,231).

Claim 38 inherits all limitations of claim 34. As noted above, Shively et al. in combination with Lindholm disclose all limitations of claim 34. The do not however disclose providing automatic gain control.

However, Miller et al. teaches in Fig. 18, providing automatic gain control. It would have been obvious to one skilled in the art at the time of invention to incorporate the teachings of Miller et al. as a method of processing predetermined spectral subbands within a predetermined spectral band.

28. Claims 40 is rejected under 35 U.S.C. 103(a) as being unpatentable over Shively et al. (US Patent 6,418,161 B1) in view of Lindholm (US Patent 6,477,207 B1) as applied to claim 39 above, and further in view of Ekvetchavit et al. (US 2002/0159551 A1).

Claim 40 inherits all limitations of claim 39 above. As noted above, the combination of Shively et al. and Lindholm disclose all limitations of claim 39. They do not however teach anti-aliasing filtering prior to analog-to-digital conversion.

However, Ekvetchavit et al. discloses in Fig. 2, an efficient multi carrier filter wherein he teaches anti-aliasing filtering (element 84) prior to analog-to-digital conversion.

It would have been obvious to one skilled in the art at the time of invention to incorporate the teachings of Ekvetchavit et al. as a method of removing unwanted spectral content to enhance accuracy of the analog-to-digital conversion process.

29. Claims 41, 42 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shively et al. (US Patent 6,418,161 B1) in view of Lindholm (US Patent 6,477,207 B1) as applied to claim 34 above, and further in view of Miller et al. (US Patent 5,930,231).

(1) With regard to claim 41, claim 41 inherits all limitations of claim 34. As noted above, Shively et al. in combination with Lindholm disclose all limitations of claim 34. They do not however, explicitly disclose providing adaptively controlled filtering for timing recovery.

However, Miller et al discloses in Fig. 24, providing adaptively controlled filtering for timing recovery.

It would have been obvious to one skilled in the art at the time of invention to incorporate the teachings of Miller et al. as a method of processing predetermined spectral subbands within a predetermined spectral band.

(2) With regard to claim 42, Miller et al. also discloses wherein the symbols are complex (col. 35, lines 62-64) and further providing adaptively controlled phase rotation (Fig. 18).

It would have been obvious to one skilled in the art at the time of invention to incorporate the teachings of Miller et al. as a method of processing predetermined spectral subbands within a predetermined spectral band.

30. Claim 43 is rejected under 35 U.S.C. 103(a) as being unpatentable over Shively et al. (US Patent 6,418,161 B1) in view of Lindholm (US Patent 6,477,207 B1) as applied to claim 34 above, and further in view of Rowan et al. (US Patent 6,407,843 B1).

Claim 43 inherits all limitations of claim 34 above. As noted above, the combination of Shively et al. and Lindholm disclose all limitations of claim 34 above. Furthermore, Shively et al. discloses QAM decoding (col. 10, lines 55-60). They are silent as to trellis decoding.

However, Rowan et al. also discloses trellis decoding (Fig. 4). It would have been obvious to one skilled in the art at the time of invention to incorporate the teachings of Rowan et al. for proven superior performance of the invention in a noisy environment.

31. Claim 45 is rejected under 35 U.S.C. 103(a) as being unpatentable over Shively et al. (US Patent 6,418,161 B1) as applied to claim 44 above, and further in view of Merriam, Jr. (US Patent 6,975,685 B1).

As noted above, Shively et al. discloses all limitations of claim 44, above. Furthermore, Shively et al. also discloses in Fig. 4, the system further comprising: means (element 46) for receiving data from the K channels; means for correcting the data for intersymbol interference (element 47, col. 10, lines 48-49), means (element 48) for retrieving the K subsets, and means (element 49) for retrieving the N data bits.

Shively et al. is silent as to the means for retrieving including a down-converter that down-converts in a single step.

However, Merriam, Jr. discloses in Fig. 6, an apparatus and method for multi-channel communications systems wherein he discloses a receiver including a down-conversion circuit (elements 602-606) corresponding to separated channels that down converts to a base-band signal in a single step (col.6, lines 44-65).

It would have been obvious to one skilled in the art at the time of invention to incorporate the teachings of Merriam, Jr. as a method of efficiently method of receiving signals that maximizes the use of hardware resources (col. 2, lines 3-6).

32. Claims 46-47, 51 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shively et al. (US Patent 6,418,161 B1) in view of Merriam, Jr. (US Patent 6,975,685 B1) and further in view of Applicant's Admitted Prior Art.

(1) With regard to claim 1, Shively et al. discloses in Fig(s) 3, 4, a transceiver chip, comprising: a transmitter portion (Fig. 4, elements 41-44) coupled to receive N parallel bits of data and transmit the N parallel bits of data into K frequency separated channels on a conducting transmission medium (Fig. 3, element 15, twisted pair) where N and K are integers (col. 10, lines

30-45), and a receiver portion coupled to receive data from a second set of K frequency separated channels from the transmission medium and recover the N parallel bits of data (elements 16-19, Fig. 3). The second set of frequencies are N QAM tones generated by modulation of the symbols with respective sub-carriers. Shively is silent as to a down-conversion circuit.

However, Merriam, Jr. discloses in Fig. 6, an apparatus and method for multi-channel communications systems wherein he discloses a receiver including a down-conversion circuit (elements 602-606) corresponding to separated channels that down converts to a base-band signal in a single step (col.6, lines 44-65).

It would have been obvious to one skilled in the art at the time of invention to incorporate the teachings of Merriam, Jr. as a method of efficiently method of receiving signals that maximizes the use of hardware resources (col. 2, lines 3-6).

Though both inventors are silent as to the implementation of the invention, transceiver chips are well known to one of ordinary skill in the art.

However, Applicant's Admitted Prior Art teaches a transceiver chip for the exact purpose of Shively's invention (pg. 1, line 21, pg. 2, line 22).

It would have been obvious to one skilled in the art at the time of invention to incorporate the teachings of Applicant's Admitted Prior Art as a method of implementing a conventional SERDES device.

(2) With regard to claim 47, claim 47 inherits all limitations of claim 46 above. Furthermore, Shively et al. also discloses wherein the first set of K separated channels have substantially identical carrier frequencies with the seconds set of K frequency separated

channels, since the received separated channels will have substantially the same carrier frequency with which they were modulated and transmitted.

(3) With regard to claim 51, Shively et al. also discloses in Fig. 4, wherein the receiver comprises: K demodulators (48), each of the K demodulators coupled to receive a signal from the conducting transmission medium, the signal being the transmit sum signal transmitted through the conducting transmission medium, and retrieving one of the K subsets of data bits; and a bit parsing circuit (element 49) that receives each of the K subsets of data bits from the K demodulators and reconstructs the N data bits transmitted by the transmitter (col. 10, lines 52-61).

33. Claims 48-49 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shively et al. (US Patent 6,418,161 B1) in combination with Merriam, Jr. (US Patent 6,975,685 B1) and Applicant's Admitted Prior Art as applied to claim 46 above, and further in view of Esteban et al. (US Patent 4,55,649).

As noted above, Shively in combination with Merriam et al. and Applicant's Admitted Prior Art disclose all limitations of claim 1 above. Shively also discloses K modulators (Fig. 4, element 42, the multi-carrier modulator contains a plurality of modulators, one for each QAM channel) wherein each of the K modulators encodes one of the K subsets of the N parallel bits of data and creates an output signal modulated at a carrier frequency associated with one of the K frequency separated channels (col. 10, lines 30-45); and an adder (element 44, col. 10, lines 48-52) that receives the output signal from each of the K modulators and generates a transmit sum signal for transmission on the conducting transmission medium (element 15).

They do not however disclose a bit allocation circuit that receives the N parallel bits of data and creates K subsets of data bits, though Shively does disclose a serial to parallel buffer for allocation of bits (col. 10, lines 62-67).

However, Esteban et al. discloses in Fig. 1A, a method and apparatus for efficient statistical multiplexing of voice and data signals wherein he discloses a bit allocation circuit (element 14) that receives parallel bits of data and creates subsets of data bits (col. 5, lines 44-51).

It would have been obvious to one skilled in the art at the time of invention to incorporate the teachings of Esteban et al. as a method of increasing efficiency in the system.

(2) With regard to claim 49, Shively et al. also discloses in Fig(s). 3, 4, wherein at least one of the K modulators includes a data encoder (Fig. 3, element 13) that receives the one of the K subsets of the N parallel bits of data associated with the at least one of the K modulators and outputs an encoded signal; a symbol mapper (Shively et al. teaches a QAM tones for each channel with a respective constellation, col. 10, lines 39-41) coupled to receive the encoded signal and output a symbol; and an up-converter coupled to receive symbols from the symbol mapper and generate the output signal, wherein the up-converter outputs data at the carrier frequency of one of the K frequency separate channels that corresponds with the at least one of the K modulators (col. 10, lines 43-47). Shively et al. teaches the modulator modulating N subcarriers by corresponding symbols to generate N QAM tones, which would inherently imply and up-converter.

34. Claim 50 is rejected under 35 U.S.C. 103(a) as being unpatentable over Shively et al. (US Patent 6,418,161 B1) in combination with Merriam, Jr. (US Patent 6,975,685 B1), Applicant's Admitted Prior Art and Esteban et al. (US Patent 4,55,649) as applied to claim 49 above, and further in view of Rowan et al. (US Patent 6,407,843 B1).

Claim 50 inherits all limitations of claim 49 above. As noted above, the combination of Shively et al., Merriam, Jr., Applicant's Admitted Prior Art and Esteban et al. disclose all limitations of claim 49, above. Furthermore, Shively et al. also discloses wherein the symbol mapper is a QAM symbol mapper (col. 10, lines 36-40). They are silent as to a trellis encoder.

However, Rowan et al. discloses in Fig. 4, the use of a trellis encoder (406). It would have been obvious to one skilled in the art at the time of invention to incorporate the teachings of Rowan et al. as a proven method of achieving superior performance in a noisy environment.

35. Claim 52 is rejected under 35 U.S.C. 103(a) as being unpatentable over Shively et al. (US Patent 6,418,161 B1) in combination with Merriam, Jr. (US Patent 6,975,685 B1) and Applicant's Admitted Prior Art as applied to claim 51 and further in view of Lindholm (US Patent 6,477,207 B1).

Claim 52 inherits all limitations of claim 51 above. As noted above, the combination of Shively et al., Merriam, Jr., an Applicant's Admitted Prior Art teach all limitations of claim 51. Furthermore, Shively discloses in fig. 4, the down-conversion circuit (48) that receives the signal from the transmission medium and generates a symbol by converting the signal at the carrier frequency appropriate for one of the K demodulators in the single down conversion step (col. 10, lines 58). They do not however disclose an equalizer circuit coupled to receive the symbol from

the down-conversion circuit and create an equalized symbol; and a decoder which receives the equalized symbol and retrieves the one of the K subsets of bits associated with the at least one of the K demodulators.

However, Lindholm teaches in Fig. 9c, an equalizer circuit (93) coupled to receive the symbol from the down-conversion circuit and create an equalized symbol; and a decoder (47) which receives the equalized symbol and retrieves the one of the K subsets of bits associated with the at least one of the K demodulators (col. 9, lines 23-40).

It would have been obvious to one skilled in the art at the time of invention to incorporate the teachings of Lindholm as a method of implementing simple and efficient modulation and demodulation scheme where bit streams are transmitted on carriers on different bands or channels.

Conclusion

36. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

a.) Hyll discloses in US Patent 6,005,893 Reduced Complexity Bit Allocation To Subchannels In A Multi-Carrier High Speed Transmission System.

b.) Liu et al. discloses Forward Compatible And Expandable High Speed Communication System And Method Of Operation.

c.) El-Ghoroury et al. discloses in US Patent 6,724,331 B1 Adaptive Digital Spectral Compensation And Calibration Of Analog Components And Transceiver Chain.

d.) Subramanian et al. discloses in US 20010031014 A1 Method For Allocating Bits And Power In A Multi-Carrier Communication System.

e.) Bohm discloses in US Patent 6,246,664 B1 Modulator For Modulating Digital Signals.

37. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lawrence B Williams whose telephone number is 571-272-3037. The examiner can normally be reached on Monday-Friday (8:00-5:00).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ghayour Mohammad can be reached on 571-272-3021. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Lawrence B. Williams

lbw
May 12, 2006

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